

which determines the function $E(x)$, a rational and entire function of the n th degree.

I conclude this paper with a proposition of much importance in the theory of linear differential equations,

Let

$$\phi_n x \frac{d^n y}{dx^n} + \phi_{n-1} x \frac{d^{n-1} y}{dx^{n-1}} + \phi_{n-2} x \frac{d^{n-2} y}{dx^{n-2}} + \dots + \phi_0 xy = 0$$

be any linear differential equation. Then in general this equation will not admit a solution of the form $y = f(\epsilon^x)$. For then, putting for (x) successively $x + 2\pi i$, $x + 4\pi i$, \dots , we should have

$$\phi_n(x) \frac{d^n f(\epsilon^x)}{dx^n} + \phi_{n-1} x \frac{d^{n-1} f(\epsilon^x)}{dx^{n-1}} + \phi_{n-2} x \frac{d^{n-2} f(\epsilon^x)}{dx^{n-2}} + \dots = 0,$$

$$\phi_n(x + 2\pi i) \frac{d^n f(\epsilon^x)}{dx^n} + \phi_{n-1}(x + 2\pi i) \frac{d^{n-1} f(\epsilon^x)}{dx^{n-1}} + \dots = 0,$$

$$\phi_n(x + 4\pi i) \frac{d^n f(\epsilon^x)}{dx^n} + \phi_{n-1}(x + 4\pi i) \frac{d^{n-1} f(\epsilon^x)}{dx^{n-1}} + \dots = 0.$$

And these equations can be indefinitely continued. It will be observed that this solution does not comprise integrals of the form $\frac{P}{Q} \frac{u}{\epsilon^v}$, where $\frac{u}{v}$ is a rational function.

February 17, 1870.

Dr. WILLIAM ALLEN MILLER, Treasurer and Vice-President,
in the Chair.

The following communications were read :—

- I. "On a distinct form of Transient Hemiphsia." By HUBERT AIRY, M.A., M.D. Communicated by the Astronomer Royal. Received January 6, 1870.

(Abstract.)

From a comparison of the different accounts of "Hemiphsia," "Half-vision," or "Half-blindness," given by Dr. Wollaston (Phil. Trans. 1824, p. 222), M. Arago (Annales de Chimie et de Physique, tom. xxvii. p. 102), Sir David Brewster (Phil. Mag. 1865, vol. i. p. 503, and Transactions of Royal Society of Edinburgh, vol. xxiv. part 1), the Astronomer Royal (Phil. Mag. July 1865, vol. ii. p. 19), Professor Dufour (in a letter to the Astronomer Royal), Sir John Herschel (Familiar Lectures on Scientific Subjects, p. 406, Lecture IX., and private letters), Sir Charles Wheatstone (in a private letter), Mr. Tyrrell (On the Diseases of the Eye, 1840, vol. ii. p. 231), and the author of this paper, it is plain that there are different forms of transient Hemiphsia, irrespective of the wide primary distinction

between the transient and permanent forms, which have all been included under the same name Hemiopia or Hemiopsia.

It seems that Wollaston, Arago, Brewster, and Tyrrell are describing one form of the transient affection, while Sir John Herschel, Sir Charles Wheatstone, the Astronomer Royal, Professor Dufour, and the author agree in describing another.

In the experience of the former group, the limits of the blind region, as projected on the field of view, are ill-defined; there is no variety of colour, and the progress of the disease presents no remarkable features.

In the latter group, the blind region is at first very small, and gradually spreads outwards, to left or right, with a zigzag margin of bright and dark lines, tinged in most cases with various colours,—clear vision gradually returning in the centre and following the outward advance of the curved cloud; usually the blindness occupies only one lateral half of the field of view; but in one very remarkable instance recorded by Sir John Herschel, the course of the cloud was from the extreme left to the extreme right, sweeping over the whole of the visual area.

Possibly the gap between these two forms may be filled by connecting links, as further evidence arises, and it may be found that they differ only in degree of prominence of different features. The remarkable account given by Sir Charles Wheatstone (who has kindly given permission for its publication), where the zigzag luminous lines are strongly marked, but without colour, perhaps offers the first link in the connecting chain.

The author's experience dates from 1854. Since then he has repeatedly suffered from these attacks. The circumstances and features of the complaint have varied somewhat in different attacks, but the type has remained unaltered from that time to this.

The blindness comes on usually while the eyes are engaged in toilsome reading: some word or letter on the page near the sight-point (generally below to the left) is found to be obliterated; this germ of blindness slowly spreads, with zigzag margin, defined by alternate bright and dark lines, with gleams of colour, the margin rapidly trembling and slowly rolling at the same time.

These three orders of motion, (1) gradual outward growth of the whole, (2) slow rolling of parts, (3) rapid tremor of the margin, are especially characteristic of this affection.

The region of blindness takes a horseshoe shape; the upper arm points to the centre of sight, while the lower spreads downwards and outwards away from the centre. The zigzag pattern is minute near the centre, and grows larger the further it recedes. The gleams of colour, most conspicuous at the margin, are red and blue, yellow, green, orange, in order of frequency. As the blindness spreads outwards, clear vision returns gradually in the concavity of the horseshoe. The sight of both eyes is affected at once, exactly in the same manner and in the same degree; though naturally that eye *seems* most affected which corresponds to the obliterated side of

the field of view, because the nasal half of the field of view of either eye is more limited, and vision there is less distinct than on the temporal side.

Looking at any surface of uniform colour, the cloud partakes of the general hue of the field on which it lies, and shows little that is characteristic except its bright margin, tremor, and boiling.

Against bright light a faint shadowy curved cloud is seen, with bright margin, tremor and boiling, and slight colour.

Against dark shade the cloud is seen to show faint light.

When part of the cloud is seen against dark shade and part against bright light, the boundary between the light and shade is wholly obliterated.

Viewed in the dark, the cloud presents inherent luminosity, especially at the margin. Its various colours are seen as well in dark as in light.

The cloud spreads outwards in horseshoe shape till it reaches the outskirts of the field of view, and fades away after great boiling and turbulence. The lower arm is the first to fade, then the middle, and finally the upper arm, which remains pointing to the centre of the field to the very last.

The climax is reached in about twenty-five minutes from the first beginning. The whole duration of the attack is just half an hour.

Often, midway in the attack, a fresh germ of blindness arises near the birthplace of the first, but always proves abortive unless it takes root on the opposite side, when a second attack may develope itself immediately after the first.

This half-blindness is followed by oppressive headache, lasting many hours.

From the resemblance of the angular margin of the cloud to a fortified wall "with salient and reentering angles, bastions, and ravelins" (to use Sir John Herschel's words), the author ventures to suggest the name *Teichopsia* for this striking form of transient half-blindness.

Among the circumstances that have seemed to favour an attack may be mentioned sudden change of air and living, over-exercise, and insufficient sleep. The attack has sometimes been nocturnal.

The most usual position of the germ of blindness is 3° or 4° below, and 3° or 4° to the left of the centre of vision.

In one or two cases, after reaching a certain stage, the cloud has parted in the middle, and died away without ripening.

The cloud, whether developed in the right or the left half of the field, has never (the author believes) transgressed the vertical median line.

Lately, one or two attacks have been followed by a slight disturbance of hearing.

Of three cases coming under the author's immediate observation, in one these attacks have been very frequent, from an early age to middle life. The bastioned outline is always present, with more or less colour. Formerly the attendant headache used to be very severe, accompanied with prolonged vomiting. Latterly the blindness has been more oppressive than

the headache, and its advent greatly dreaded. The speech is often affected, and sometimes the memory; and on one occasion the mouth was noticed to be drawn to one side. The cause has seemed to be mental anxiety.

In the second case, which is adduced for the sake of contrast, the phenomena are much less definite. There is no serrated margin, no colour, no curve, nothing of which a picture can be made. The obscurity grows from a small but ill-defined germ, and gathers like a cloudy film or gauze over the field, oppressive to the eyes, and accompanied by headache and nausea, and passes away after a doubtful period, leaving the impression that it is caused by disorder of the stomach.

In the third case, the blindness is sometimes brought on by looking at a striped wall-paper or a striped dress. The appearance before the eyes is described as zigzag, wavy, quivering, without colour. The first attack, in adult age, was followed by partial paralysis of one side, and later attacks have almost always had a sequel of defective speech, and tingling at the tip of the tongue, at the tip of the nose, and in the fingers and thumb.

At any rate it is certain that there does exist a distinct form of transient hemipopsia, presenting the following main characteristics:—

1. Dependence on mental anxiety, bodily exhaustion, overwork to the eyes, gastric derangement (?), want of exercise.
2. Origin from a small germ near the centre of vision.
3. Orderly centrifugal growth from the original germ.
4. Blindness to boundaries, but not to general impressions of light and colour.
5. Proper luminosity in the dark.
6. Bright-bastioned margin, with gleams of various colours.
7. Tremor and “boiling.”
8. Gradual occupation of one lateral half of the field of view.
9. Gradual recovery of clear vision in rear of the outward-growing cloud.
10. Disappearance of the phenomenon after about half an hour.

11. Sequelæ: headache and nausea, and sometimes affection of speech and hearing, and even symptoms of hemiplegia.

As to the actual seat of the visual derangement, the exact agreement of the two eyes in the nature, extent, and degree of their affection proves (assuming the semidecussation of the optic nerves at the chiasma) that the seat of the affection must lie at some point behind the chiasma of these nerves. All the causes that are found to lead to transient half-blindness point to the brain as the seat of disturbance. Still clearer is the evidence given by the loss of speech and of memory, the derangement of hearing, and the partial paralysis that sometimes follow an attack of teichopsia. Such cases as Sir John Herschel's, where the cloud passed over the whole field from left to right, can only be explained by supposing the disturbance to lie in some region of the brain where the opposite halves are

in contact. The mischief may possibly be seated in the corpora quadrigemina or geniculata, or even in the cerebellum itself.

As to the nature of the mischief in the brain, it is difficult to do more than hazard guesses. Is it a temporary suspension of function among the nerve-cells of the visual sensorium, due to vascular congestion, and relieved by the relief of that congestion? Does the headache tell of the further propagation of the nervous disturbance into parts of the brain where disturbance is ache, as in the visual tract disturbance is abnormal sensation of light? And the detriment to speech and hearing,—does it mean extension of the same disturbance still further into the regions of brain-substance appropriate to those functions? Or is the attack in any way analogous to a fit of epilepsy?

The phenomena are so definite and so localized, and their course is so regular, that we can hardly avoid the conviction that their cause is equally definite and equally localized; and it is difficult to admit so vague an agent as nervous sympathy with gastric derangement, except as acting through the medium of some secondary local manifestation in the brain.

II. "Account of the Great Melbourne Telescope from April 1868 to its commencement of operations in Australia in 1869." By ALBERT LE SUEUR. Received January 8, 1870. Communicated by the President.

A description of the great Melbourne reflector, and its history, up to the time of inspection by the Committee, have been communicated to the Royal Society; the following additional account of the doings connected therewith since the instrument was consigned to my care may be of interest to the Society.

Mr. Grubb commenced taking down the telescope at the end of April 1868; this was accomplished in no great length of time, and without any difficulty. The specula (by the advice of Mr. Lassell, who had found this method answer perfectly) were coated over with shellac varnish to prevent oxidation on the voyage out; they were then protected in their cells and on their lever supports by strong double wood casings, and the other parts of the telescope and machinery cased or otherwise protected. The only casualty which there seemed to be any reason to fear could give rise to any serious consequences was a tilting over of the speculum cases; their great weight was, perhaps, a sufficient guarantee from such an event: it was nevertheless thought prudent that the telescope, and machinery generally, should not be left entirely to the tender mercies of the shipping and crane labourers; I was therefore present at the shipping in Dublin on board a steam-tug hired for the purpose, and at the transshipment in Liverpool, on board the 'Empress of the Seas.'

Both these operations were performed satisfactorily, and without any serious casualty.